

2.—Stratigraphy Of The Lower Murchison River Area And Yaringa North Station, Western Australia *

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The Cretaceous sediments in the lower Murchison River area have been mapped in detail and several formations are re-defined. The "Tutula Sandstone" is demonstrated to be equivalent to the Birdrong Formation and the former name may therefore be abandoned. The Cretaceous succession is included in the Winning and Cardabia Groups.

On Yaringa North Station are exposures of Toolonga Calcilutite (Cretaceous), Giralia Calcarenite (Eocene) and Trealla Limestone (Miocene).

Introduction

The lower Murchison River area includes the country around the Murchison River and its tributaries downstream from Mount Curious on

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Murchison House Station. The Cretaceous sediments discussed in this paper are exposed in that area. Yaringa North Station is 8 miles south-east of the mouth of the Wooramel River. Tertiary and Cretaceous sediments outcrop in this area. The locations of the areas to be discussed are shown on Figure 1.

This paper is based on geological mapping undertaken by West Australian Petroleum Pty. Limited and the Bureau of Mineral Resources in 1954. Dr. M. F. Glaessner, Reader in Geology and Palaeontology, University of Adelaide and consultant to the above-mentioned company, and D. J. Belford of the Bureau of Mineral Resources, studied the foraminiferal assemblage of the Cretaceous formations and the ages quoted are based on their work.

Forman (1937), Clarke and Teichert (1948) and Fairbridge (1953) have previously conducted geological investigations in the lower Murchison River area.

Stratigraphy

Table 1 compares the new proposed nomenclature for the sediments of the lower Murchison area with that of previous authors.

TABLE 1.

PROPOSED NEW NOMENCLATURE		FAIRBRIDGE (1953)		CLARKE AND TEICHERT (1948)			
CRETACEOUS	Cardabia Group (Lower Part)	Toolonga Calcilutite	CRETACEOUS Murchison House Group	Second Gully Shale	CRETACEOUS Murchison House Series	Upper Series	Second Gully Shale
	Winning Group	Alinga Formation		Toolonga Chalk		Toolonga Chalk	
		Thirindine Formation		Alinga Greensand		Alinga Beds	
		Birdrong Formation		Thirindine Shale		Thirindine Shale	
OLDER PALAEOZOIC	Tumblagooda Sandstone	PERMIAN	Tutula Sandstone	Butte Sandstone	Lower Series	Tumblagooda Sandstone	
			Tumblagooda Sandstone	Tumblagooda Sandstone			

The Cretaceous sediments overlie the Tumblagooda Sandstone, which is believed to be older Palaeozoic in age, with an angular unconformity. The Tumblagooda is not discussed further in this paper.

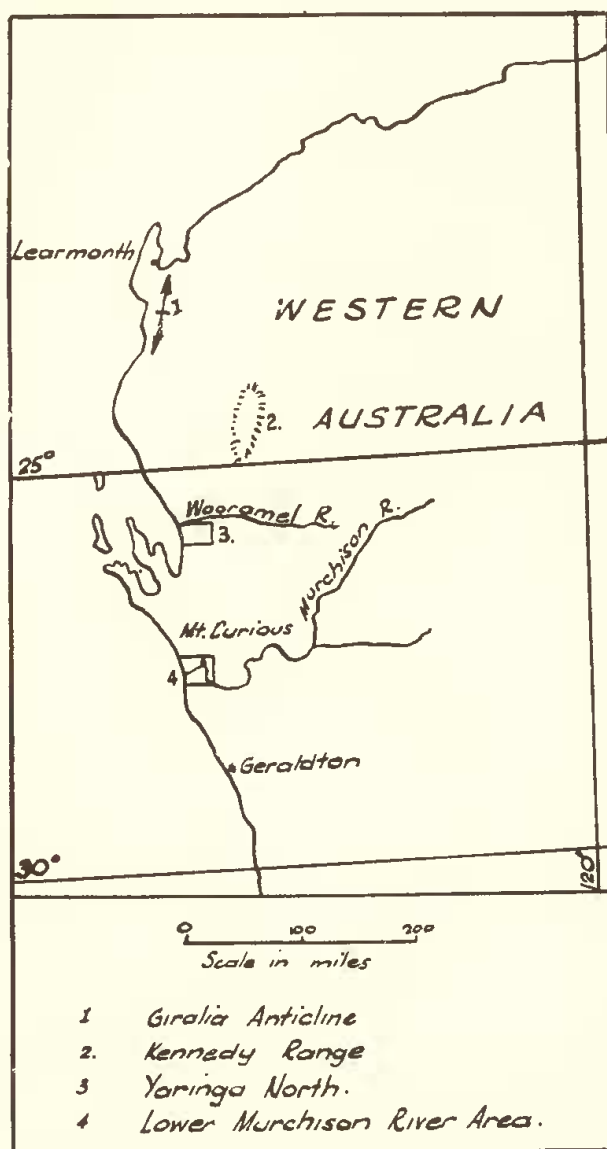


Fig. 1. LOCALITY MAP

Cretaceous

Birdrong Formation

Clarke and Teichert (1948) proposed the name "Butte Sandstone" for this Cretaceous unit and derived the name from a conical hill (a butte) at latitude 27°36', longitude 114°9½'. As "butte" is not a geographical name and therefore invalid, Fairbridge (1953) used the name "Tutula" (from Tutula Well, latitude 27°37', longitude 114°9') and regarded the "Tutula Sandstone" as being Permian in age.

A comparison of the "Tutula Sandstone" with the type area (west side of the Kennedy Range) of the Birdrong Formation (Condon, 1954) shows the following points of similarity:—

1. The two formations are basal transgressive units of the Cretaceous and unconformably overlap older sedimentary formations;

2. The thickness of each of the two formations is about 100 feet;
3. Both formations are crudely bedded, poorly cemented, medium- and coarse-grained quartz sandstones with glauconite near the top;
4. Both contain pelecypods and silicified fossil wood.

These points of similarity and the fact that the Birdrong of the Kennedy Range area can be traced as an artesian and sub-artesian aquifer through dozens of water bores to the "Tutula Sandstone" of the lower Murchison River, show that the Birdrong Formation and the "Tutula Sandstone" are the same formation. Therefore, one of the names (Birdrong or Tutula) is superfluous. Although Tutula has priority because it was published first, we propose (with Dr. Fairbridge's approval) that the name Birdrong be used because:—

1. Fairbridge (1953) referred to the Birdrong Formation, although it had not been defined in a publication;
2. The name Birdrong has become widely used and is well known as an artesian and sub-artesian aquifer, and as an oil reservoir.

On the lower Murchison River the Birdrong Formation overlies the Palaeozoic Tumblagooda Sandstone with an angular unconformity of up to 2½ degrees, and underlies the Thirindine Formation conformably (see below).

Clarke and Teichert's type section at "Butte Hill" is poorly exposed and we propose that the well exposed section at "Bidgie Bidgie Point" (latitude 27°34', longitude 114°13') become the reference section for the lower Murchison River.

The section of the Birdrong Formation at "Bidgie Bidgie Point," in descending order, is:—

Thirindine Formation

- 1 foot Greensand, fine-grained, silty, sandy, green.
- 7 feet Sandstone, quartz, coarse and medium, silty, glauconitic, yellow; fossil bone and wood.
- 33 feet Sandstone, quartz, medium and coarse, grey.
- 22 feet Sandstone, quartz, fine-grained, well sorted, grey.
- 36 feet Sandstone, quartz, medium-grained, poorly sorted, grey, some glauconite.
- 3 feet Sandstone, quartz, medium-grained, poorly sorted, yellow.
- 3 feet Siltstone, sandy (coarse-grained).
- 2 feet Sandstone, coarse-grained, poorly sorted, and conglomerate, fine quartz, yellow; in basal 6 inches are ¼-inch rounded pebbles of sandstone from Tumblagooda Sandstone.

Tumblagooda Sandstone

107 feet

The top one to three feet of the Birdrong is sandy, glauconitic, silty and slightly calcareous, and possibly may be equivalent to the Muderong Shale of Condon (1954).

Fossil bone and *Teredo*-bored fossil wood occur in the Birdrong Formation. At Pillarawa Hill (latitude 27°28½', longitude 114°17½') pelecypods were collected in the top 18 feet. At present the age of the formation can be determined only by reference to its position relative to the overlying Cretaceous formations, the ages of which are known from foraminifera. The Birdrong Formation is regarded as being possibly Neocomian in age.

Thirindine Formation

Clarke and Teichert (1948) proposed and defined the Thirindine "Shale". The name was taken from Thirindine Point (latitude 27°36', longitude 114°11½').

The formation consists of alternating 1 to 3-foot units of moderately hard radiolarite with glauconite, and soft, grey and green radiolarian siltstone, and shale with glauconite. As the Thirindine "Shale" of Clarke and Teichert has several lithologies interbedded and is not mainly shale, it is renamed Thirindine Formation.

Clarke and Teichert restricted the Thirindine to the white, hard beds of "siliceous shale". This "siliceous shale" (radiolarite) is interbedded with radiolarian shale and claystone, and the overlying sediments all contain abundant radiolaria and are fine-grained and thin-bedded to laminated. Only the greensand at the base of the Alinga Formation as here defined is sufficiently distinct in lithology to make a satisfactory formation boundary. For these reasons the Thirindine Formation is extended up to the base of the basal greensand of the Alinga Formation.

The Thirindine Formation is conformable with the underlying Birdrong Formation and the overlying Alinga Formation.

The Thirindine Formation is better exposed at Toolonga Point than at Thirindine Point and we suggest that the type section be at Toolonga Point where the section, in descending order, is:—

Alinga Formation

- 16 feet Shale, soft, dark grey, radiolarian, carbonaceous, bentonitic.
- 27 feet Interbedded radiolarite, soft, pale brownish-grey, thin-bedded, bentonitic, and shale, soft, dark grey, laminated, radiolarian, bentonitic.
- 29 feet Radiolarite, white, interbedded moderately hard to soft, thin-bedded to laminated; little glauconite.
- 3 feet Interbedded radiolarite, white, moderately hard, thin-bedded, and siltstone, grey, bentonitic, laminated; Belemnites.
- 2 feet Radiolarite, white, moderately hard, glauconitic;

Birdrong Formation

77 feet

Radiolaria are common, and belemnites, pelecypods, ammonites and fossil wood occur in the basal 25 feet of the formation. An examination of the microfauna suggests a probable age of Aptian (Lower Cretaceous).

Alinga Formation

Clarke and Teichert (1948) proposed and defined the "Alinga Beds" and derived the name from Alinga Point (latitude 27°37', longitude 114°7½'). Fairbridge (1953) renamed the unit "Alinga Greensand". Although the Alinga is glauconitic it is mainly glauconitic siltstone with some beds of glauconitic sandstone and of greensand. We propose therefore to rename the unit Alinga Formation.

The Alinga Formation consists of green, glauconitic siltstone (in places carbonaceous), glauconitic fine-grained sandstone and dark green greensand. The base of the Alinga is taken at the base of the greensand.

The formation conformably overlies the Thirindine Formation and disconformably underlies the Toolonga Calcilutite.

The type section at Alinga Point, in descending order, is:—

Toolonga Calcilutite

- 3 inches Bed with phosphatic nodules.
- 10 feet Siltstone, clayey, glauconitic, green and grey.
- 31 feet Siltstone, glauconitic, carbonaceous, dark grey; Belemnites.
- 9 feet Greensand, fine- and medium-grained, clayey, dark green.

Thirindine Formation

50 feet

More accessible exposures of the Alinga Formation are at "Bidgie Bidgie" and Thirindine Points.

The Alinga Formation is correlated with the Gearle Siltstone of Condon *et al.* (1956). The microfauna of the Gearle and Alinga Formations indicates an Albian to Cenomanian age.

Toolonga Calcilutite

Clarke and Teichert (1948) defined the "Toolonga Chalk" and named it after the Toolonga Hills (latitude 27°34', longitude 114°12½'). They also proposed and defined the "Second Gully Shale" which conformably overlies the Chalk.

Clarke and Teichert had difficulty in mapping the "Second Gully Shale" and apparently never saw a good exposure of it or of its contact with the "Toolonga Chalk." The Second Gully is a calcilutite and the boundary between the chalk and the calcilutite is difficult to map with certainty both in outcrop and in the water bores to the north of the lower Murchison River area.

Therefore, we propose that the name Toolonga, which is well known geologically, be applied to Clarke and Teichert's Toolonga and Second Gully formations. As the lithology throughout the area is mainly a calcilutite the formation is called the Toolonga Calcilutite.

The formation overlies the Alinga Formation disconformably. Its top is generally travertinised at the Tertiary erosion surface.

The type section is two miles north of Yal-thoo Well at latitude $27^{\circ}35\frac{1}{2}'$, longitude $114^{\circ}10\frac{1}{2}'$. The section, in descending order, is:—

Travertine

- 17 feet No outcrop.
- 5 feet Calcilutite, light greenish-yellow, soft, with flint nodules.
- 12 feet Calcilutite, light greenish-yellow, soft, "shaly" appearance, bright green clay in pockets and "veins."
- 26 feet Calcilutite, light green, soft, bedded (3 to 4 inches); *Gryphaea*, *Ostrea*, Echinoid Spines, and small fragments of *Inoceramus* in basal 12 feet.
- 25 feet Chalk, massive, yellow-white, and white, with flint nodules. *Marsupites*, *Uintacrinus*, *Inoceramus* fragments.

Alinga Formation

85 feet

Three miles south-west of the Yaringa North Homestead are exposed 50 feet of green calcilutite which is the top part of the Toolonga Calcilutite.

The foraminiferal assemblage and the *Marsupites* and *Uintacrinus* fix the age of the chalk as Santonian. The foraminifera of the calcilutite show that the age is Campanian. The basal 10 feet of the calcilutite is transitional from the Santonian to the Campanian.

Winning, Cardabia and Murchison House Groups

After mapping the Cretaceous formations on the Giralia Anticline and on the west edge of the Kennedy Range, Condon, Johnstone, Prichard and Johnstone (1956) defined the *Winning Group* as consisting of the Muderong Shale, Windalia Radiolarite and the Gearle Siltstone. A disconformity occurs at the top of the *Winning Group*.

We propose the inclusion of the Birdrong Formation in the *Winning Group*, which then constitutes a sedimentational unit starting with a transgressive sand above an unconformity and finishing at the next unconformity. As thus redefined the *Winning Group* comprises, in ascending order, Birdrong Formation, Muderong Shale, Windalia Radiolarite and Gearle Siltstone.

Two of the Cretaceous formations of the lower Murchison River can be broadly correlated with those of the *Winning Group*, e.g., the Thirindine Formation with the Windalia Radiolarite, and the Alinga Formation with the Gearle Siltstone.

Condon *et al* (1956) defined the *Cardabia Group* as "the sediments which disconformably overlie the Gearle Siltstone of the *Winning Group* and disconformably underlie the Giralia Calcarenite. The group is characterized by calcarenites, generally glauconitic, with minor calcilutites, marl, and greensand."

The upper part of the Toolonga Calcilutite is similar in lithology and age to the base of the Korojon Calcarenite (of Condon *et al.*, 1956) and the Toolonga may therefore be included in the Cardabia Group.

It is proposed that the "Murchison House Group" of Fairbridge (1953) be abandoned and that the terms *Winning* and *Cardabia* Groups be extended to the lower Murchison River area.

The Birdrong, Thirindine and Alinga Formations are included in the *Winning Group*, and the Toolonga Calcilutite is included in the *Cardabia Group*.

Eocene

Giralia Calcarenite

On Yaringa North and Wooramel Stations are isolated outcrops of *Giralia Calcarenite* (of Condon *et al.*, 1956) which are not in contact with any other formation.

The lithology is yellowish-green glauconitic limestone with foraminifera (*Discocyclina*), Bryozoa, echinoids, pectens and brachiopods.

Small outcrops of the *Giralia* occur $6\frac{3}{4}$ miles east-north-east of Wooramel Homestead and $6\frac{3}{4}$ and $8\frac{3}{4}$ miles north-east of Yaringa North Homestead. The thickest exposure is about 10 feet.

Miss I. Crespin of the Bureau of Mineral Resources, Canberra, examined samples and found *Discocyclina* and *Asterocyclina*, which denote a Middle to Upper Eocene age.

Miocene

Trealla Limestone

Hard, grey, crystalline limestone of the *Trealla Limestone* (Condon, Johnstone and Perry, 1953) outcrops from 4 miles south to $1\frac{1}{2}$ miles north of Yaringa North Homestead. The maximum thickness is 25 feet.

The *Trealla Limestone* disconformably overlies the Toolonga Calcilutite but it was not seen to overlie the *Giralia Calcarenite*.

Miss I. Crespin examined samples and found the foraminiferal assemblage characteristic of the Lower Miocene *Trealla Limestone*.

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